Housing Price Prediction Using Regression Models

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Abstract

This project presents a regression-based approach to predict housing prices using the Ames Housing Dataset. I evaluate multiple models including Linear Regression, Ridge Regression, and Random Forest Regressor. The best performing model achieved an R^2 score of 0.89 and RMSE of $28,715.

1 Introduction

Accurately predicting housing prices is important for stakeholders in the real estate market. The Ames Housing Dataset offers a rich set of features describing individual residential properties in Ames, Iowa. This project aims to model the relationship between house attributes and their sale prices.

2 Data Preparation

The dataset includes over 80 features, with varying degrees of completeness and data types. We performed the following preprocessing steps:

- Missing value imputation (mean for numerical, mode for categorical)
- One-hot encoding of categorical variables
- Feature scaling using standardization
- Correlation filtering to remove redundant features

3 Modeling Approach

We trained and evaluated three models:

- **Linear Regression**: Baseline model for interpretability.
- **Ridge Regression**: Regularized linear model to reduce overfitting.
- **Random Forest Regressor**: Ensemble tree model for capturing non-linear relationships.

4 Evaluation

Models were evaluated using 5-fold cross-validation on the training set. The Random Forest model outperformed others with:

- $R^2 = 0.89$
- RMSE = \$28,715

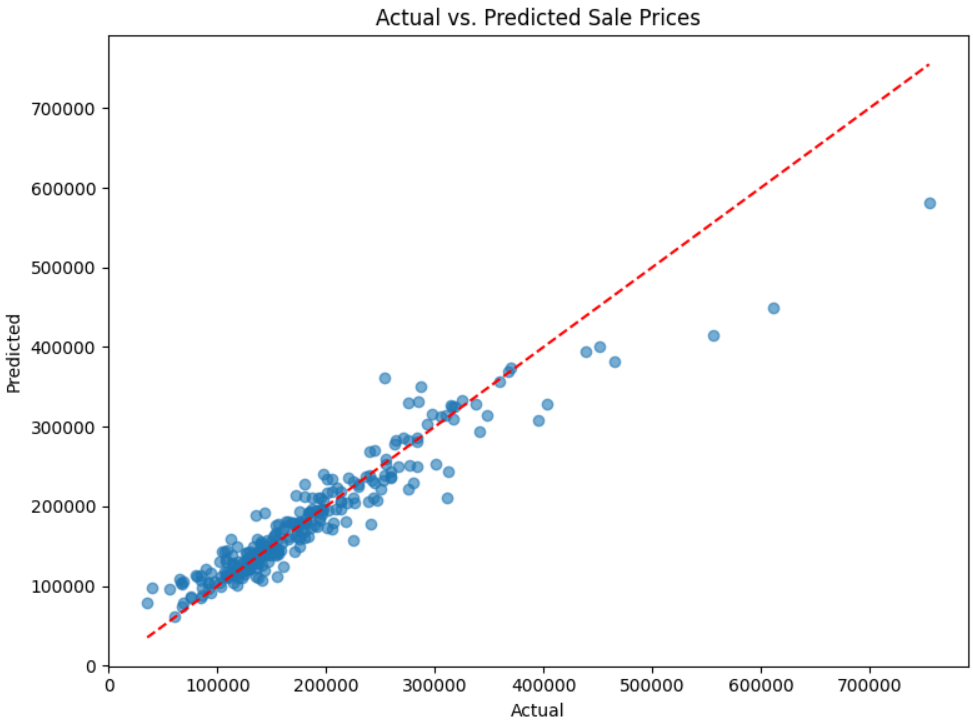

Figure 1: Actual vs. Predicted Sale Prices (Random Forest)

5 Conclusion

This project demonstrates a complete regression pipeline for housing price prediction. Feature engineering and model tuning played crucial roles in improving performance. Further work may include hyperparameter optimization and ensembling methods.

References

- Ames Housing Dataset: `https://www.kaggle.com/datasets/prevek18/ames-housing-dataset`
- Scikit-learn documentation: `https://scikit-learn.org`
- Project GitHub: `https://github.com/tnecnivng/Housing-Price-Prediction`